

Environmental Monitoring 2005 Data Report

Prepared by:
Environmental Monitoring Programme Staff
Editor: Ian Buchanan

For:
Environment Waikato
PO Box 4010
HAMILTON EAST

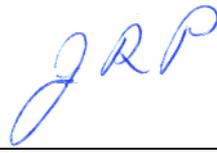
ISSN: 1172-4005

March 2006

Document #: 1050016

Peer reviewed by:
Jim Price

Signature



Date March 2006

Approved for release by:
Dr Vivienne Smith

Signature



Date March 2006

Acknowledgements

This report was written by Environmental Monitoring staff and edited by Ian Buchanan. Jim Price provided guidance on the report's format and content.

The following staff in the Resource Information Group, Environment Waikato, assisted in the collection, processing, analysis and compilation of information contained in this report:

Alan Berry-Cope, Ian Blair, Ian Buchanan, Nicholas Holdwerda, John Hughey, Bevan Jenkins, Ross Jones, Johlene Kelly, Ralph Ostertag, Kelly Palmer, Jeremy Piper, Nathan Singleton, Paul Smith and Doug Stewart.

Thanks also to landowners in the Environment Waikato Region for their co-operation and providing access to the many sites and stations.

Disclaimer

While Environment Waikato has exercised all reasonable skill and care in the contents of this report, it accepts no liability in contract, tort or otherwise for any loss, damage, injury or expense (whether direct, indirect or consequential) arising out of the provision of this information or its use by you.

Due to the dynamic nature of environmental information collection, changes may occur to statistics in enclosed tables as datasets increase, so the most recent data or statistics should be requested from Environment Waikato. Please phone (07) 859 0999 or email inforeq@ew.govt.nz

Table of Contents

Acknowledgements	ii
Disclaimer	ii
1 Introduction	1
2 Data Management	1
2.1 General	1
3 Quality Management	1
3.1 Data Availability	1
3.2 How to Contact Us	1
4 Directions	2
4.1 Work Programme 2005/2006	2
4.2 Technology	2
5 Summary	2
5.1 Information Network	3
6 Telemetry System	3
7 Usage of Data	4
7.1 Information Requests	4
8 Rainfall Data	5
8.1 General	5
8.2 Manual Sites	5
8.3 Automatic Stations	5
9 Surface Water Level Data	5
9.1 General	5
9.2 Manual Sites	5
9.3 Automatic Stations	6
10 Water Flow Data	6
10.1 General	6
10.2 Manual Sites	6
10.3 Automatic Stations	6
11 Groundwater Level Data	7
11.1 General	7
11.2 Manual Sites	7
11.3 Automatic Stations	8
12 Surface Water Temperature Data	8
12.1 General	8
12.2 Manual Sites	8
12.3 Automatic Stations	8
13 Water Quality Data	9
13.1 General	9
13.2 Manual Sites	9
13.3 Automatic Stations	9
13.4 Groundwater Quality	9
14 Suspended Sediment Data	10

14.1	General	10
14.2	Manual Sampling	10
14.3	Automatic Sampling	10
15	Ecological Stream and River Monitoring Data	11
15.1	Regional Ecological Monitoring of Streams	11
16	Coastal Monitoring	11
16.1	Regional Estuary Monitoring Programme	11
16.2	Beach Profiles	11
17	Bathing Beach Bacteriological Sampling	12
17.1	Bathing Beach Bacteriological Sampling	12
17.2	Lake Taupo - Bathing Beach Bacteriological Sampling	12
18	Geothermal Data	13
18.1	General	13
18.2	Methodology	13
19	Air Quality	13
19.1	Ambient Air Quality Monitoring	13
20	Clean Streams	13
20.1	General	13
20.2	Methodology	14
21	Waikato Catchment Services (previously Project Watershed)	14
21.1	General	14
21.2	Methodology	14
22	Updates to Report	15

Figures

Figure 1:	Information Requests Actioned By Environmental Monitoring	4
Figure 2:	Size of Flow Monitoring Network, 1990 – 2005	6
Figure 3:	Number of Gaugings Completed, 1990 - 2005	7
Figure 4:	Number of Bores in the Groundwater Level Monitoring Network	8

Tables

Table 1:	Summary of 2005 Automatic Recorders	3
Table 2:	Current Automatic Sediment Sampling Sites	10

1 Introduction

Environment Waikato is required to collect environmental information to comply with its obligations under Section 32 of the Resource Management Act 1991. The Environmental Monitoring Programme, Resource Information Group of Environment Waikato is responsible for much of this collection. The Environmental Monitoring Programme is ISO 9001:2000 registered through Telarc New Zealand for the supply of environmental information and services, including water quality, biological sampling, air quality, land and rating information and geographical information systems.

This report summarises the information collected during the 2005 calendar year.

2 Data Management

2.1 General

Since data is being collected continuously (Environmental Monitoring's 102 automatic stations generate more than eight million data points each year) good management of the data is essential. Procedures are continually being reviewed and improved in conjunction with the quality system. Extreme events, such as floods or droughts, necessitate that previous work (such as level/flow ratings) is reviewed for accuracy. The compilation and regular review of a Processing and Reporting Manual have improved consistency of data processing, analysis and management.

3 Quality Management

To ensure that the database is current and free from major errors, four monthly quality management audits are run. These present the collected data graphically, make comparisons and check for accuracy. Any deficiencies are followed up and corrected.

3.1 Data Availability

Real time data is available at all telemetered stations. Data is supplied provisionally until the satisfactory operation of the instrumentation is confirmed.

Data is downloaded at most automatic stations at eight weekly intervals but some remote telemetered stations are serviced at two or three month intervals. Data is processed, checked and archived within two weeks of the station inspection.

The flow / level relationship (rating), derived using flow gaugings, is affected by bed movement or change in the control. As the full range of flows is gauged, the rating is adjusted to complement the gaugings. Since these improvements can be done at any time, users are encouraged to obtain flow data directly from Environmental Monitoring.

3.2 How to Contact Us

Requests for data associated with this report can be made by;

Email: infoeq@ew.govt.nz
Phone: (07) 859 0999
Fax: (07) 859 0998

Under current policy, data are free but there is a charge for the time taken to access the data. This charge is waived for certain users, such as educational institutions.

General enquiries to Environment Waikato may be made by

Phone: (07) 859 0999 or Environment
Waikato's Freephone 0800 800 401

General information about Environment Waikato may be found on our web site. Real time river levels and rainfall information from some sites is also available on the web.

Web Home Page: www.ew.govt.nz
Web River Levels: <http://www.ew.govt.nz/enviroinfo/riverlevelsandrainfall/index.htm>
Web Rainfall: <http://www.ew.govt.nz/enviroinfo/riverlevelsandrainfall/index.htm>
Web Groundwater: <http://www.ew.govt.nz/enviroinfo/water/groundwater/levels/index.htm>
Web Water Temp: <http://www.ew.govt.nz/enviroinfo/water/temperature/index.htm>

4 Directions

4.1 Work Programme 2005/2006

Data capture will continue and quality control methods for incoming data will be improved as required.

Environmental Monitoring's role is being widened to include responsibility for the importation, quality assurance and archiving of more diverse forms of environmental information.

The ISO 9001 quality system will ensure procedures are closely followed and modified as required. As additional areas of work are added to the programme, they will be incorporated in the quality system.

Providing information to customers is an integral part of Environmental Monitoring's service. Regular requests for resource consent information for data analyses are anticipated, particularly in response to extreme events.

4.2 Technology

An increased use of ultrasonic and radar technology is being made in the measurement of open channel levels. Acoustic doppler technology is being investigated for the measurement of open channel flows, particularly high flows. Other environmental parameter sensors, such as those used in climate stations, are evaluated as required.

5 Summary

This report has summarised environmental data collected by the Environmental Monitoring Programme during 2005.

Procedures used are in accordance with those outlined in the Quality Manuals. Data is stored on Environment Waikato's computer system and undergoes quality assurance checking at four monthly intervals.

Data is readily available. Under current policy, data is free to all users but there is a charge for the time taken to access the data. This charge is waived for certain users, such as educational institutes.

The ISO 9001 quality system is given priority and the scope of registration will be increased to cover all activities completed by the Environmental Monitoring Programme. Data capture statistics and equipment performance are reviewed and used to improve performance.

5.1 Information Network

Table 1 shows the Environmental Monitoring Programme collected over 200 separate time series data sets from 102 permanent recorders and 34 temporary automatic recorder sites in the Region during 2005. These are installed for specific purposes, such as flood and resource management and resource consent monitoring. Over fifty stations are linked directly to the office by a telemetry system.

Table 1: Summary of 2005 Automatic Recorders

Permanent Recorders			
Sites	Type	Parameters	Data Sets
25	Rainfall	Rain (24), Flood Warning (1)	25
51	Surface Water	Level (51), Flow (38), Water Temperature (12)	101
2	Coastal	Sea Level (2), Wave Amplitude, Wind Speed, Wind Direction, Wind Gust, Barometric Pressure	7
10	Groundwater	Level	10
5	Air Quality	Wind Speed (4), Wind Direction (4), Air Temperature (4), Particulate Matter <10 microns (5)	17
2	Climate	Rainfall(2), Groundwater Level (4), Climate parameters (10)	16
7	Lake Level	Level (7) Temperature (3)	10
102	Totals		186
Temporary/Portable Recorders			
Sites	Type	Parameters	Data Sets
23	Water Quality	Water Temperature (Onset Loggers)	23
6	Water Quality	Water Temperature, pH, Dissolved Oxygen (mg/l & %), Turbidity, Conductivity, Chlorophyll A	38
8	Water Quality	Suspended Solids, Turbidity	33
34	Totals		83

In addition to the automatic stations there are manual sites where measurements are taken at regular intervals. Manual sites are operated where less detailed information is required and the information collected may be correlated with adjacent automatic stations once a base of data is established.

6 Telemetry System

The flood warning and data acquisition system, *HydroTel* is a SCADA (supervisory, control and data acquisition) system and is capable of handling a wide range of field interfaces. It is also versatile in output and can direct messages to phone, pager, facsimile, modem or database. *HydroTel* handles alarms and data transfer to the Hamilton office.

Some of these sites are used for extreme event warning and are programmed with thresholds that trigger alarms, which are sent back to Environment Waikato's Hamilton office and then out to duty officers.

The telemetry system is also used to operate three floodgates (Lake Waikare Outlet, Whangamarino Control Structure and Te Onetea Stream) in the Lower Waikato Waipa Control Scheme and ten floodpumps on the lower Waihou flood scheme.

The locations of some telemetered stations can be found at:

Web River Levels: <http://www.ew.govt.nz/enviroinfo/riverlevelsandrainfall/index.htm>

Web Rainfall: <http://www.ew.govt.nz/enviroinfo/riverlevelsandrainfall/index.htm>

Latest readings and the last seven days data can be found using the web links shown above. For earlier data please contact the following:

Email : inforeq@ew.govt.nz

Phone: (07) 859 0999

Fax : (07) 859 0998

7 Usage of Data

7.1 Information Requests

Usage of archived data is significant. A database was set up during 1993 to monitor this usage and to ensure that all requests are satisfactorily and promptly answered.

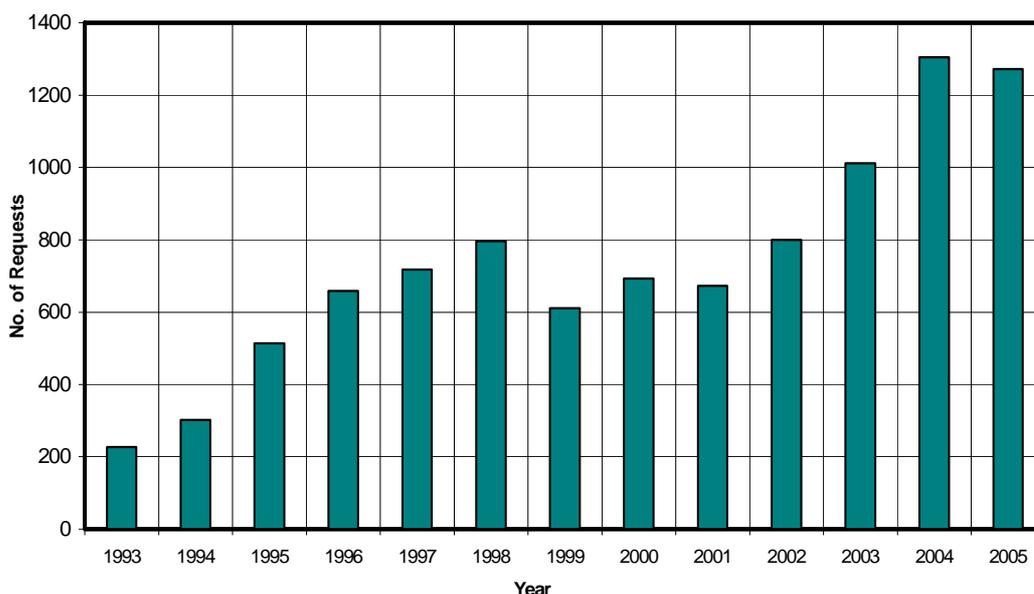


Figure 1: Information Requests Actioned By Environmental Monitoring Staff, 1993 – 2005

Since the database are accessible to all Environment Waikato computer users and agencies who contribute to the NIWA National Archive, the number of requests is likely to be well in excess of the number of requests logged and actioned. Also not included is real time data, available 24 hours per day and used in the flood warning, river system management and the large number of data sets that are accessible to all staff through corporate applications and databases. e.g. GIS layers.

8 Rainfall Data

8.1 General

Environmental Monitoring archives rainfall data collected by observers and from automatic stations. Additional sources of rainfall data include NIWA, Genesis and Mighty River Power. Enquiries regarding NIWA rainfall data should be directed to the address shown below.

The National Climate Database

NIWA

PO Box 14-901

Kilbirnie

WELLINGTON

Email: climate-enquiries@niwa.co.nz

Tel: (04) 386 0300

Fax: (04) 386 0574

8.2 Manual Sites

Manual sites are operated by observers who typically take readings of accumulated rainfall from a gauge each day at 9 am. The results are returned to Environment Waikato every two months and are entered onto the computer database.

The archived data come from sites operated by Environment Waikato volunteers in the Region.

8.3 Automatic Stations

Where rainfall intensity information is needed, an automatic station is installed and readings of accumulated rain are taken every five minutes during each rain event. All gauges measure rainfall to a precision of 0.5 mm. Most Environment Waikato stations are also telemetered for flood warning purposes.

9 Surface Water Level Data

9.1 General

A manual surface water level station is used mainly in water resource allocation projects and water level readings taken are converted to flow using a rating.

An automatic surface water level station will typically measure the level of a stream, river, wetland or lake. Stations in the Firth of Thames and Whitianga Harbour record coastal sea levels.

Levels are used for many purposes, including flood warning, resource management and resource consent applications.

9.2 Manual Sites

The installation at a manual site typically includes a staff gauge in the water channel and one or more benchmarks. Greater emphasis is now given to correlating flow rather than establishing a rating; however if the control is stable, rating can be a cost-effective method of accumulating basic flow information.

9.3 Automatic Stations

An installation includes a recorder and sensor, staff gauge and three benchmarks. Stations are visited typically at eight weekly intervals and a biennial inspection check undertaken for changes in any of the reference points.

10 Water Flow Data

10.1 General

Water flow (discharge) may be measured using a number of techniques including volumetric measurement, chemical dilution, slope/area and float gauging. The one most commonly used at Environment Waikato is current meter gauging.

A current meter gauging indirectly measures discharge by determining cross-sectional area and velocity in a channel section. The discharge is obtained by multiplying these two parameters together.

10.2 Manual Sites

A manual flow site has a site installation similar to that of a manual water level station, with perhaps structures such as slacklines, to assist in flow measurement. Flow gauging is done on a regular basis to build up a level/flow relationship (rating). The accuracy of the rating required by the customer will determine the gauging frequency. A stream or riverbed that is unstable or affected by weed will necessitate more frequent measurements.

10.3 Automatic Stations

A continuous record of flow at a station is obtained by combining water level data with the rating. To ensure that the rating is accurate over the range of recorded levels, it is important to gauge at low, medium and high levels. Flood events or channel modification may cause a rating change, which then requires another series of gaugings to define the new rating curve.

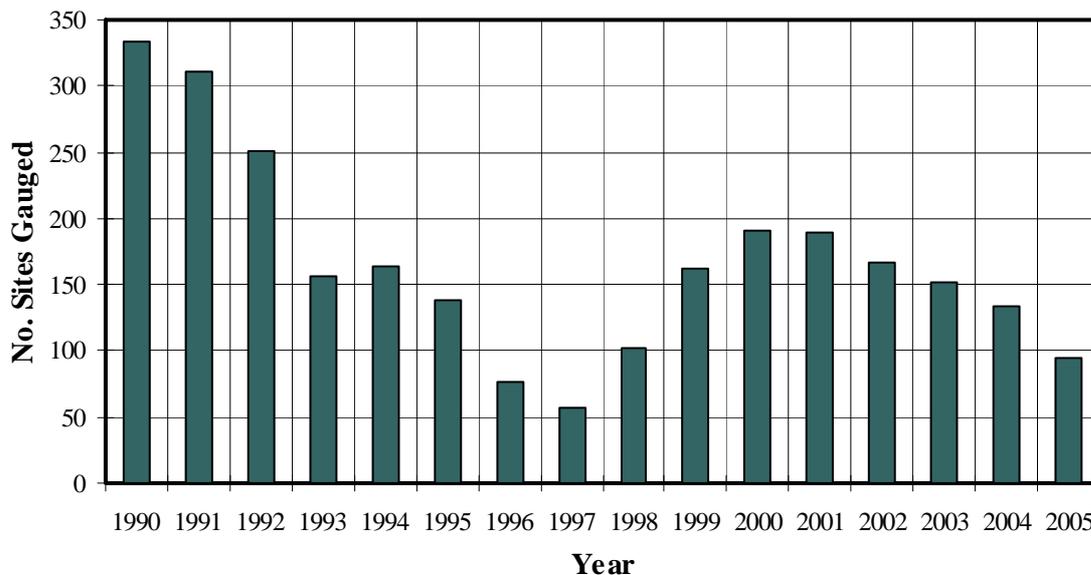


Figure 2: Size of Flow Monitoring Network, 1990 – 2005

Gaugings are generally done only at sites where customers have requested flow information. Figure 2 shows the number of sites gauged increased from 1997 peaking in 2000/2001 followed by a gradual decline, while the number of gaugings completed (Figure 3) has remained relatively static.

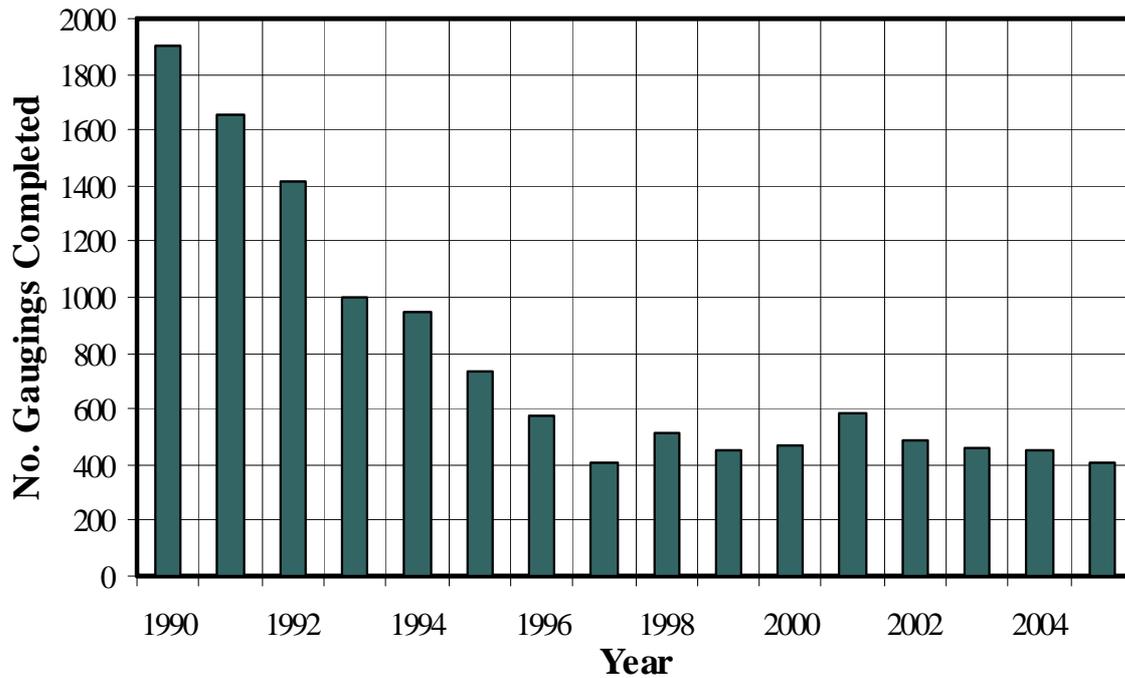


Figure 3: Number of Gaugings Completed, 1990 - 2005

11 Groundwater Level Data

11.1 General

Groundwater level is measured using a calibrated depth probe.

Groundwater level measurements (both manually and automatically collected) are filed as the distance down from the top of the bore or well. The levels for these reference points have been calculated in terms of Mean Sea Level.

It is important to contrast the above with surface water stations which operate above (not below) a specific reference level.

11.2 Manual Sites

Previous emphasis in groundwater level data collection has been on manual observations; however adequate data has been collected to enable selected bores to predict levels at adjacent sites. In 2005, 293 bores were manually monitored.

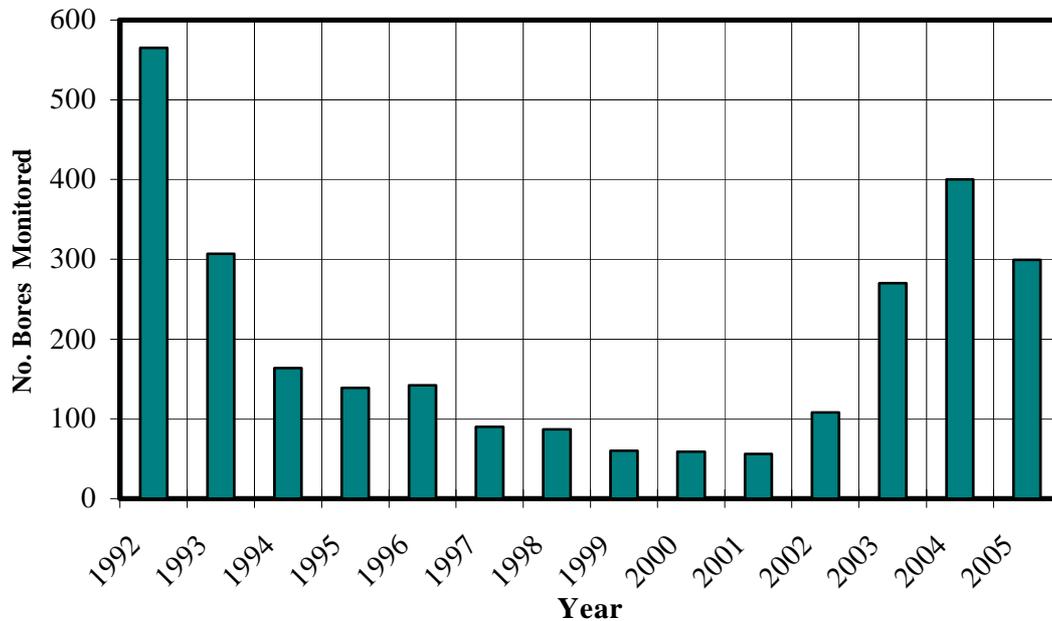


Figure 4: Number of Bores in the Groundwater Level Monitoring Network (manual), 1992 - 2005

11.3 Automatic Stations

Seven automatic stations, continuously recording groundwater levels, were operating during 2005. The first station (Hamilton) was installed during July 1997 and monitors levels using a logger and Metritape. A second station at Matamata Airfield was opened during 1998, monitoring four different aquifers, (water table, 20m, 40m, 163m). Four automatic diving loggers were installed in August 2002, monitoring shallow groundwater levels within the northern and western Lake Taupo catchments. In 2005 diving loggers have been installed at Cooks Beach (2), Hahei (1) and Opoutere (1).

A routine 6 weekly site inspection downloads data, and manual measurements are taken using a probe to check the calibration of the sensor.

12 Surface Water Temperature Data

12.1 General

Surface water temperature is measured manually and automatically at selected flow stations. Manual temperature readings may be taken at the time of flow gaugings and as part of regional water quality sampling.

12.2 Manual Sites

Manual readings of water temperature are usually taken using a digital thermometer. Samples as part of flow gaugings are taken in the channel as far into the flow as practicable. Temperature measurements taken during water sampling are taken from a bucket sample collected mid-stream or from the stream bank.

12.3 Automatic Stations

Water temperatures are taken at least hourly at automatic stations. Station inspections occur at 8 to 10 weekly intervals and manual readings with a digital thermometer are used to detect deviation of the logged temperature from the true temperature.

13 Water Quality Data

13.1 General

All Environment Waikato water quality results with a geographic location are filed in Hydrol. Over 3600 samples were analysed during 2005; over 97 percent of these were related to a geographic location.

Automatic samples are also taken at selected sites for specific projects. These water quality measurements are taken using Datasonde logger/sensor instruments and are typically operated for three-day periods.

Reports on the Regional Rivers and Waikato River are available and can be obtained by contacting Environment Waikato's Freephone 0800 800 401 or e-mailing inforeq@ew.govt.nz. Much of the information contained in these reports is available on our web site www.ew.govt.nz

13.2 Manual Sites

Water was sampled from lakes, rivers, streams, underground and the coast. The Regional River Monitoring project, with 1200 samples from 100 sites, is the largest project. The most comprehensive project (Waikato River) determines 39 parameters routinely compared with others of only one.

13.3 Automatic Stations

13.3.1 Datasondes

Datasondes were deployed at six Waikato River sites. These deployments typically measured water temperature, pH, dissolved oxygen, turbidity and conductivity, with chlorophyll A monitored at two sites. Readings were taken at 20-minute intervals.

13.3.2 Onset Temperature Loggers

Onset temperature loggers were deployed at twenty three river sites. These loggers recorded water temperature at between 15 and 30 minute intervals.

13.4 Groundwater Quality

In 2005 a total of 448 samples were taken from 202 groundwater sites which are broken into several monitoring programmes (Regional Groundwater, National Groundwater Monitoring Programme, Taupo & Coromandel Groundwater Projects, Pesticides and Groundwater Nitrates).

Regional groundwater monitoring is undertaken on an annual basis with 19 parameters determined for 114 sites. 10 sites are monitored quarterly as part of the National Groundwater Monitoring Programme. Routine water parameters are determined on a quarterly basis at 38 sites as part of the Lake Taupo Project. Pesticides are monitored at 20 sites annually across the region and 24 sites are monitored for Nitrates on a quarterly basis. A total of 10 samples were collected and analysed for either total arsenic or acid soluble arsenic.

14 Suspended Sediment Data

14.1 General

Suspended sediment is currently sampled at 22 sites when appropriate river levels are reached in an effort to provide regional coverage of suspended sediment yield. Six of these sites have ISCO automatic samplers installed. Sampling is conducted over the full range of flow conditions and from this the general relationship between flow and sediment concentration can be determined.

14.2 Manual Sampling

Water samples are collected and analysed to determine sediment concentrations. The typical method used is depth integrated sampling whereby a sample is collected vertically through the entire water column at 3 predetermined distances across the channel. A single sediment discharge value can then be calculated from these 3 samples when they are combined with the concurrent flow gauging data.

14.3 Automatic Sampling

The automatic sediment sampling programme was initiated in 1997 with 6 sites presently having ISCO automatic water samplers installed. A focus of recent work has been to collect manual sediment gauging data concurrent with automatic sampling in order to calibrate the automatic data.

Table 2 details the sites where automatic samplers are currently deployed along with the corresponding start date and number of high flow events sampled.

Table 2: Current Automatic Sediment Sampling Sites

Site number	Source	Location name	Start Date	No. of events sampled
660.1	Optonui River	Downstream Awaroa Confluence	16/07/1999	44
1191.7	Waipa River	Otewa	01/10/2000	16
443.4	Mangapu River	SH3 Bridge Upstream of Mangaokewa Confluence	12/12/2000	31
1167.4	Waingaro River	Ruakiwi Rd off SH22	10/06/2002	21
516.5	Matahuru Stream	Waiterimu Rd	30/07/2003	14
476.7	Mangatutu Stream	Walker Rd Bridge	22/06/2004	15

15 Ecological Stream and River Monitoring Data

15.1 Regional Ecological Monitoring of Streams

The Regional Ecological Monitoring of Streams (REMS) programme was established by Environment Waikato to assess the physical habitat and biological condition of streams and small river systems. It is a bio-assessment method using protocols developed by the New Zealand Macroinvertebrate Working Group. Investigations use a series of habitat scores and benthic invertebrate community compositions as indicators of ecological condition.

Sampling involves evaluating habitat attributes throughout a representative 100-metre reach of each stream, followed by sampling of stream invertebrates from representative stream habitat types with a kick net. Invertebrates are identified and counted to provide a picture of community structure.

Sites are either reference sites, which were selected to represent relatively, unimpacted stream habitats or monitoring sites, which provide information on the impact of major resource use in the Waikato Region.

16 Coastal Monitoring

16.1 Regional Estuary Monitoring Programme

The Regional Estuary Monitoring Programme (REMP) was established by Environment Waikato for the purpose of monitoring the long-term changes in benthic macrofauna communities and the sediments they live in which may occur as a direct or indirect consequence of catchment activity and/or estuary development.

Currently the REMP involves routinely monitoring five permanent sites in both the southern Firth of Thames and Whaingaroa (Raglan) Harbour. The ecological component is based on monitoring a suite of 26 “indicator” species/taxa characteristic of intertidal communities. Sampling involves the collection of 12 replicate core samples (13 cm diameter and 15 cm deep) from a permanent 100 m² area at each permanent site. Macrofauna are separated from the sediment by sieving (500 µm mesh), preserved with 70% isopropyl alcohol in seawater and stained with 0.1% Rose Bengal. In the laboratory, the macrofauna are sorted, and the indicator species/taxa identified and counted. The sediment component of the REMP involves the collection of sediment samples from each site for the analysis of a suite of parameters including surface sediment grain size distribution, organic matter content and pigment concentration. The rate of deposition/erosion at each site is measured using square concrete tiles (0.3 x 0.3 m) buried to a depth of 0.2 m, where the distance from the sediment surface to the plate is measured using knitting needles. Macrobenthic community composition and measured sediment variables are analysed using multivariate statistics. Trends in environmental gradients and macrobenthic communities can then be used to infer estuary health.

16.2 Beach Profiles

Beach profile sampling is done to monitor dune erosion. Many beaches on the Coromandel Peninsula (predominantly the eastern seaboard) are in the network. The frequency of sampling depends on the occurrence of storm events and demand for data, but is typically done two monthly, annually or 10 yearly.

The number and spacing of manual sites (profiles) along each beach is determined by historical and potential damage to property on the frontal dunes. Consideration is also given to Environment Waikato's responsibility to collect baseline data as outlined in the Resource Management Act.

Each profile is referenced to a benchmark of known level and distance to enable comparison. Each survey runs from this point toward and beyond the water's edge. A project is presently being undertaken to put all surveys into one common datum.

The archive containing the profile data has been amalgamated with that of NIWA and now includes their data collected prior to March 1997, along with all Environment Waikato data.

Surveys also include photographs of the profile from four positions: seaward, landward, up and down the beach.

At present consultants survey profiles from Whiritoa to Whangapoua inclusive on a regular basis (usually two-monthly). Environment Waikato's emphasis at present is to survey the remainder of the network, where possible in conjunction with this work. Sites involved are from Port Jackson to Kennedy Bay and at Opoutere Beach.

An annual survey of sites from Northland to Bay of Plenty to be done each September was started in 2002 in conjunction with other agencies. This was completed in September 2005.

Sites north of Coromandel township were profiled in February (12 profiles completed), March (12), June (15), September (17), and December (14). The sites at Opoutere were profiled in February (5), March (5), June (5), September (3) and December (5). A total of 95 profiles were completed by staff in 2005.

17 Bathing Beach Bacteriological Sampling

17.1 Bathing Beach Bacteriological Sampling

A listing of all the beaches sampled over the 2003 - 2005 summer period are provided at <http://www.ew.govt.nz/enviroinfo/coasts/coastwaterquality/swim/>

The results from these surveys are held in the Environment Waikato Hydrol database. Parameters measured included water temperature, salinity, enterococci and faecal coliforms.

Results to date have indicated that the beaches sampled generally do not have bacteriological water quality problems.

17.2 Lake Taupo - Bathing Beach Bacteriological Sampling

A listing of all the beaches sampled over the 2003 - 2005 summer period are provided at <http://www.ew.govt.nz/enviroinfo/water/lakes/laketaupo/waterquality/taupomap/>

The results from these surveys are held in the Environment Waikato Hydrol database. Parameters measured included water temperature, black disk, e-coli, enterococci and faecal coliforms.

Results to date indicate that Lake Taupo does not have bacteriological water quality problems.

18 Geothermal Data

18.1 General

Areas which are, or have the potential to be, commercial geothermal sources of energy are regularly monitored. These areas include Ohaaki, Wairakei and Taupo.

18.2 Methodology

Groundwater levels are taken six weekly for a representative network of 17 bores. Levels in eight additional bores in Taupo are measured twice yearly.

Water temperature profiles are also constructed for some of these bores using a calibrated thermocouple, which is lowered down the bore. Five bores were profiled during 2005.

Flows from hot water springs are measured using calibrated weirs and water temperature is taken. In some instances the springs have completely dried up and regular photographs are taken as evidence of this.

19 Air Quality

19.1 Ambient Air Quality Monitoring

Air quality monitoring was carried out by Environment Waikato at a number of sites within the region during 2005. These included Hamilton, Tokoroa, Te Kuiti, Taupo and Matamata. Results from these monitoring sites are reported in Environment Waikato Document number 1053377.

In Hamilton, concentrations of suspended particles (PM₁₀), and benzene were measured at the Peachgrove Road air quality monitoring site. In addition, benzene monitoring was carried out at a "traffic peak" monitoring sites in Bridge Street and Victoria Street. In Taupo, Te Kuiti, Tokoroa and Matamata monitoring was carried out for PM₁₀.

Information on the air quality indicators can be found on the following web page; <http://www.ew.govt.nz/enviroinfo/indicators/air/index.htm>

20 Clean Streams

20.1 General

Clean Streams is an Environment Waikato project to encourage and support farmer efforts to reduce the impacts of farming on waterways. Fencing off streams, lakes, rivers and wetlands to keep stock out of them is one of the most effective ways of protecting waterways from the effects of farming. The fenced area filters out pollutants and can be planted with trees and shrubs to further enhance the environment.

The monitoring period runs for 10 years with 5 sites currently monitored and additional locations yet to be added to the project. The monitoring approach includes the recording of stream temperatures, ecological sampling, and the taking of water samples for turbidity analysis and is carried out at a number of representative sites throughout the region. The results of this monitoring can be used as indicators of the quality of stream habitat. At each location a control site is also monitored to illustrate that any changes in stream temperature observed over time are a result of fencing and planting along a given reach of stream rather than some other external factor. Photographing the planted and fenced reaches of stream

is another part of the monitoring strategy and is undertaken to provide a visual reference of change.

The initial data sets will provide baseline information to which subsequent data can be compared.

20.2 Methodology

Water temperature loggers are deployed in the stream securely attached to a waratah driven into the stream bed. Typically the loggers are deployed in early December and retrieved in March so as to capture the higher summer water temperatures as these are most likely to influence stream habitat.

The ecological monitoring is a bio-assessment method using protocols developed by the New Zealand Macroinvertebrate Working Group. Investigations use a series of habitat scores and benthic invertebrate community compositions as indicators of stream ecological condition. This monitoring is conducted mid-summer.

Water samples are taken downstream and upstream of the planted/fenced reach of stream for turbidity analysis to determine if water clarity changes through the reach. These samples are taken when the temperature loggers are retrieved toward the end of summer.

Photos are taken starting at the location of the logger downstream of the planted and fenced reach moving upstream into the upper stream reaches. The photos are also taken when the temperature loggers are retrieved.

21 Waikato Catchment Services (previously Project Watershed)

21.1 General

Waikato Catchment Services is a rating system funding flood protection, soil conservation and river management in the Waikato River catchment.

An absence of detailed riparian information throughout the region in terms of quantifying estimates of the amount of riparian fencing, vegetation, and erosion led to the development of the Riparian Characteristics Survey (RCS). This survey method has been adopted as part of the Project Watershed environmental monitoring programme. The initial data provides baseline information to which subsequent data can be compared. The monitoring approach also includes the recording of stream temperatures, ecological sampling, photos and the taking of water samples for turbidity analysis.

The monitoring period will initially run for 10 years and currently monitoring programmes have commenced in 4 “priority” catchments throughout the region with other catchments to be added.

21.2 Methodology

The RCS monitoring involves field observations in selected catchments to quantify estimates of the amount of fencing, vegetation, and erosion along a series of 1 kilometre stretches of riparian margin. The data is collected with GIS software using a handheld computer. In conjunction with the RCS survey, photo points are taken at 250 metre intervals to provide a visual reference of change.

Water temperature loggers are deployed both downstream and upstream of where soil conservation work has commenced or is planned. It is anticipated that as planted vegetation along the treated reach of stream grows and increases shading influence over the stream the temperatures recorded at the downstream site will decrease relative to the temperatures recorded at the upstream site. Typically the loggers are deployed in early December and retrieved in March so as to capture the higher summer water temperatures as these are most likely to influence stream habitat.

The ecological monitoring is a bio-assessment method using protocols developed by the New Zealand Macroinvertebrate Working Group. Investigations use a series of habitat scores and benthic invertebrate community compositions as indicators of stream ecological condition. This monitoring is conducted mid-summer.

Water samples are taken downstream and upstream of the planted/fenced reach of stream for turbidity analysis to determine if water clarity changes through the reach. These samples are taken when the temperature loggers are retrieved toward the end of summer.

22 Updates to Report

Environmental Monitoring will continue to collect environmental information and will update and modify this report as necessary.